

What is claimed is:

1. A device comprising:  
a substrate; and  
a masking structure formed over the substrate, the masking structure including an amorphous carbon layer and a cap layer, wherein the cap layer includes non-oxide materials.
2. The device of claim 1, wherein the cap layer includes one of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.
3. The device of claim 1, wherein the amorphous carbon layer is transparent to radiation having wavelengths between 400 nanometers and 700 nanometers.
4. The device of claim 2, wherein the cap layer includes at least one opening.
5. The device of claim 4, wherein the amorphous carbon layer includes at least one opening continuous with the at least one opening of the cap layer.
6. The device of claim 5, wherein the masking structure further includes a photoresist layer.
7. The device of claim 6, wherein the photoresist layer includes at least one opening continuous with the at least one opening of the cap layer.
8. A device comprising:  
a substrate;  
a device structure formed over the substrate; and

a masking structure formed over the device structure, the masking structure including a mask and a cap layer, wherein the cap layer includes non-oxide materials.

9. The device of claim 8, wherein the cap layer includes one of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.

10. The device of claim 8, wherein the mask includes an amorphous carbon layer.

11. The device of claim 10, wherein the amorphous carbon layer has an absorption coefficient between about 0.15 and about 0.001 at a wavelength of 633 nanometers.

12. The device of claim 11, wherein the amorphous carbon layer has a thickness greater than 4000 Angstroms.

13. The device of claim 12, wherein the device structure has a thickness greater than 40000 Angstroms.

14. The device of claim 8, wherein the masking structure includes at least one opening.

15. The device of claim 14, wherein the device structure includes at least one trench continuous with the at least one opening of the device structure.

16. The device of claim 8, wherein the device structure includes a dielectric layer.

17. The device of claim 16, wherein the device structure includes a conductive layer.
18. A masking structure comprising:  
an amorphous carbon layer; and  
a cap layer formed over the amorphous carbon layer, the cap layer including a material selected from a group consisting of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.
19. The masking structure of claim 18, wherein the amorphous carbon layer is transparent in visible light range.
20. The masking structure of claim 18, wherein the amorphous carbon layer has an absorption coefficient between about 0.15 and about 0.001 at a wavelength of 633 nanometers.
21. The masking structure of claim 18 further comprising a photoresist layer located above the cap layer.
22. The masking structure of claim 20, wherein the masking structure includes at least one opening.
23. A memory device comprising:  
a substrate having a plurality of doped regions;  
device structure formed over the substrate, the device structure including a plurality of gate structures, a plurality of contacts, each of the contacts being located between two gate structure and contacting one of the doped regions, and an insulating layer formed over the gate structures and the contacts; and

a masking structure formed over the substrate, the masking structure including an amorphous carbon layer and a cap layer, wherein the cap layer includes non-oxide materials.

24. The memory device of claim 23, wherein the cap layer includes one of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.

25. The device of claim 23, wherein the amorphous carbon layer is transparent in visible light range.

26. The memory device of claim 23, wherein the cap layer includes at least one opening.

27. The memory device of claim 26, wherein the amorphous carbon layer includes at least one opening aligned with the at least one opening of the cap layer.

28. The memory device of claim 27, wherein the masking structure further includes a photoresist layer.

29. The memory device of claim 28, wherein the photoresist layer includes at least one opening continuous with the at least one opening of the cap layer.

30. The memory device of claim 23, wherein the device structure further includes a barrier layer located between the gate structures and the contacts.

31. The memory device of claim 23, wherein the amorphous carbon layer has a thickness of at least 4000 Angstroms.

32. The memory device of claim 21, wherein the device structure has a thickness of at least 40000 Angstroms.

33. A system comprising:

a chamber; and

a wafer placed in the chamber, the wafer including a die, the die including a substrate, a device structure formed over the substrate, and a masking structure formed over the device structure, the masking structure including an amorphous carbon layer, wherein the amorphous carbon layer and a cap layer, wherein the cap layer includes non-oxide materials.

34. The system of claim 23, wherein the cap layer includes one of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.

35. The system of claim 23, wherein the amorphous carbon layer is transparent to radiation having wavelengths between 400 nanometers and 700 nanometers.

36. The system of claim 23, wherein the cap layer includes at least one opening.

37. The system of claim 26, wherein the amorphous carbon layer includes at least one opening continuous with the at least one opening of the cap layer.

38. The system of claim 27, wherein the masking structure further includes a photoresist layer.

39. The system of claim 23, wherein the device structure includes a conductive layer.

40. The system of claim 29, wherein the device structure further includes an insulating layer.
41. The system of claim 23, wherein the at least one die includes circuitry for a memory device.
42. The system of claim 23, wherein the at least one die includes circuitry for a processor.
43. The system of claim 23, wherein the chamber is a plasma enhanced vapor chemical deposition chamber.
44. A method comprising:  
forming a masking structure over the substrate including forming an amorphous carbon layer and a cap layer, wherein the cap layer includes non-oxide materials.
45. The method of claim 44, wherein forming the cap layer includes forming the cap layer with a material selected from a group consisting of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.
46. The method of claim 44, wherein the amorphous carbon layer is transparent to radiation having wavelengths between 400 nanometers and 700 nanometers.
47. The method of claim 44, wherein amorphous carbon layer is formed by deposition.
48. The method of claim 47, wherein the cap layer is in situ deposited together with the amorphous carbon layer.

49. The method of claim 48, wherein forming the masking structure further includes forming a photoresist layer.

50. A method comprising:  
forming a device structure over the substrate; and  
forming a masking structure over the device structure, the masking structure including an amorphous carbon layer and a cap layer, the cap layer including a material selected from a group consisting of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.

51. The method of claim 50, wherein a material of the cap layer is in situ deposited over the amorphous carbon layer.

52. The method of claim 50, wherein the amorphous carbon layer is transparent in visible light range.

53. A method comprising:  
forming a device structure on a substrate;  
forming an amorphous carbon layer over the device structure;  
forming a non-oxide cap layer over the amorphous carbon layer;  
patterning the non-oxide cap layer to produce a patterned non-oxide cap layer; and  
using the patterned non-oxide cap layer as a mask to pattern the amorphous carbon layer.

54. The method of claim 53, wherein the cap layer includes one of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.

55. The method of claim 53, wherein the carbon layer has an absorption coefficient between about 0.15 and 0.001 at a wavelength of 633 nanometers.
56. The method of claim 53, wherein amorphous carbon layer is formed by deposition.
57. The method of claim 56, wherein the cap layer is in situ deposited together with the amorphous carbon layer.
58. The method of claim 57, wherein forming an amorphous carbon layer is performed by a chemical vapor deposition process.
59. A method comprising:  
forming device structure having a gate structure on a substrate;  
forming masking structure over the device structure, the masking structure includes an amorphous carbon layer and a cap layer, the cap layer including non-oxide materials;  
patterning the masking structure to form a patterned masking structure;  
etching the device structure using the patterned masking structure as a mask to form a portion of a memory cell; and  
removing the patterned masking structure.
60. The method of claim 59, wherein patterning the masking structure includes:  
using a patterned photoresist layer as a mask to pattern the cap layer to form a patterned cap layer; and  
using at least one of the patterned cap layer and the patterned photoresist layer to pattern the amorphous carbon layer.



61. The method of claim 60, wherein patterning the cap layer is performed by oxygen plasma etch process.
62. The method of claim 59, wherein removing the patterned amorphous carbon is performed using an oxygen plasma process with one of  $\text{CF}_4$  and  $\text{H}_2$ .
63. A method comprising:  
placing a wafer in a chamber, the wafer including at least one die having a substrate and a device structure formed over the substrate;  
forming an amorphous carbon layer over the device structure; and  
forming a cap layer over the amorphous carbon layer, the cap layer including a material selected from a group consisting of boron carbide, boron nitride, silicon carbide, silicon nitride, fluoride films, fluorine doped with oxide, fluorine doped with nitride, and fluorine doped with carbide.
64. The method of claim 63, wherein a material of the cap layer is in situ deposited together with the amorphous carbon layer.
65. The method of claim 63, wherein the amorphous carbon layer is transparent in visible light range.
66. The method of claim 63, wherein the chamber is a plasma enhanced vapor chemical deposition chamber.